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FIREPROOF WOOD

UNITED STATES FIREPROOF WOOD COMPANY,

2220 Race Street, Philadelphia, Pennsylvania.

INCORPORATED UNDER THE LAWS OF THE STATE OF NEW JERSEY.

Capital Stock authorized	$1,000,000
Capital Stock issued, full paid and non-assessable	$650,000

OFFICERS.

PRESIDENT,

SAMUEL HUCKEL, Jr.,

Of Hazlehurst & Huckel, Architects.

VICE-PRESIDENT,

JOHN C. SIMS,

Secretary, Pennsylvania Railroad Company.

TREASURER,

ROBERT H. GROFF.

CONSULTING ENGINEER,

JOSEPH L. FERRELL, M. E.

NON-FLAMMABLE LUMBER.

The United States Fireproof Wood Company is the owner of the apparatus and process for the fireproofing of wood, and other cellular and fibrous material, so as to render them non-flammable by what is generally known as the "Ferrell Process," the invention of Mr. Joseph L. Ferrell, which is covered by the United States patent No. 620,114, dated February 28th, 1899.

By its process, apparatus, and the chemical solution employed, lumber of all sizes for commercial purposes is thoroughly and effectively fireproofed, so that flame cannot communicate to it, no matter how fiercely, or suddenly, it may be attacked, nor how completely it may be enveloped. While untreated lumber would be rapidly consumed, the treated material is only superficially carbonized, and cannot act as a transmitter of flame. The moment flame ceases to be projected against a treated mass all carbonization ceases, and the flame-attacked surface is cool.

The treatment is done at a reasonable cost, without discoloring the lumber, and is not detrimental to its fibrous constituents, nor does it weaken or change the strength, or appearance, of any woods.

A clear and comprehensive idea may be formed of the process of fireproofing woods, and the results obtained therefrom, by a perusal of the following answers to a series of questions which have been asked by many inquirers:—

1. What does the United States Fireproof Wood Company claim for its process?

Answer: It claims that wood treated by its process is rendered flame and fire resisting to a degree never before

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known in the history of wood. Lighted gas jet, electric wires, live coals, and similar sources of fire that usually set woodwork in flames, have no effect on fireproof wood beyond locally carbonizing the same at the point where the fire touches.

2. How does the process bring about this result?

Answer: The process consists of impregnating wood throughout its pores and fibres, (not under vacuum), by hydraulic pressure, with fire-resisting chemicals in the form of solution, subsequently evaporating such solution, and leaving deposited in the pores of the wood minute crystals which are fireproofing and antiseptic.

3. Is the treatment permanent?

Answer: It is.

4. How do you know this to be the case?

Answer: The salts used suffer no diminution in weight by *indefinite exposure* to heat, dry or moist, or ordinary atmospheric air through evaporation; therefore it is a palpable fact that the same salts crystallized in the cells of the wood, where they have been forced by great hydraulic pressure, properly controlled and regulated, are absolutely protected, and cannot evaporate, and this is confirmed by the actual use of the woods.

5. Does the process increase the weight of wood treated by it?

Answer: Yes; from five per cent. to nine per cent., depending upon the original weight and character of the wood.

6. Does the treatment injure the wood for structural purposes?

Answer: It does not. Certificates of many tests made by Riehle Brothers, of Philadelphia, show the averages of the treated woods to be above the results obtained from untreated woods off of the same pieces. The results

of numerous independent tests show scarcely any variation between the treated and untreated woods, and the actual experience of using the treated woods, by reason of the antiseptic and preservative qualities of the fireproofing liquid, will undoubtedly produce results in favor of the treated woods for all practical uses. Certificates, just as they come from Riehle Brothers, Professor Edgar F. Smith, and other scientists, are at all times subject to the inspection of all inquirers.

7. Has the wood treated by your process been tested for alteration in the modulus of elasticity, in compression strength, breaking strength, and other ways by eminent scientists, who can certify to the facts?

Answer: It has, and our experience and the tests made enable us to assert that the original qualities of woods are not injured by this treatment. The work of testing is slow, but by daily tests we shall make it complete in a few months. Wood differs from iron or steel, or metals which are homogeneous in their structure. Wood is not. In a piece of timber the physical tests will show varying results in each two feet length cut off of the same timber, and the only way to get at exact facts is to test a large number of pieces treated and untreated, and work up carefully a system of averages. This we are doing, and shall continue to do, without any consideration as to expense in money, in time, or labor. It is impossible in a matter of such importance to reach just conclusions without careful and scientific investigations.

8. Can you treat all woods?

Answer: We treat every kind of wood. Oak, yellow pine, and other hard woods are resistant, and require longer time than the softer woods in general use.

9. Can you treat successfully the following woods: Ash, beech, cedar, cherry, elm, mahogany, pine, oak, and walnut?

Answer: Ash, beech, cedar, cherry, elm, pine, and walnut are easy to treat compared to mahogany and oak, but

oak and mahogany and the other woods named, *can be perfectly treated, and our investigations show that they can be heart treated only* by our process.

10. Can you treat any thickness of these woods?

Answer: We can, and do, treat all sections of these woods thoroughly. The heart treatment of these woods requiring longer time, are charged for at higher prices than the softer woods in general use. It is purely a question of time to overcome the excessive density of the hardest woods.

11. Does your treatment interfere with wood taking paint, varnish, or polish?

Answer: Wood treated by our process, as stated by the wood expert, Mr. Albert, of Philadelphia, who went into the question very exhaustively, takes paint and varnish better than untreated wood, and our experiments confirm this.

12. Does your treatment make the wood harder to work with tools?

Answer: The treated woods are not any harder to work with tools. The only difference in effect on tools is that they require more frequent sharpening.

13. Does your process season wood?

Answer: Our experiments show that the treatment perfectly seasons wood, and that it will not check, shrink, or warp.

14. Have the chemicals which you use in treating wood by your process any corrosive action on metals?

Answer: The chemical liquor is non-corrosive, non-hydroscopic, and non-volatile. The liquor has been in our cylinders and tanks, passing through and over brass, iron, and steel for months, and no sign of the least corrosion is visible. The hardest test would seem to be the alternation between wet and dry, cold and heat, where con-

tacts of the liquor are formed with all these metals, and so the evidence is conclusive after nearly one year of actual use.

15. Does the United States Fireproof Wood Company operate a plant for the fireproofing of wood?

Answer: No. It sells licenses to other individuals, or corporations, granting to them the exclusive right, in designated territory, to operate under United States patent No. 620,114, and it places every facility at the disposal of intending licensees to preliminarily assure themselves that the machinery, and process, specified in that patent will perform practically the functions named in the patent, and that the considerations named for the sale of a license constitute an aggregated sum of actual and prospective values, which will assure them of a solid basis for a profitable business from the use of the machinery and process.

The New York Fireproof Wood Company has purchased the territorial license for nearly the entire State of New York, the western portion of Connecticut, and the northern portion of New Jersey, and is now engaged in preparing for the erection of a plant on the Long Island shore of the East River, opposite Blackwell's Island, New York, capable of treating 15,000,000 feet of lumber per annum.

16. Can the United States Fireproof Wood Company prove practically that the series of mechanical constructions covered by the patent will each perform the specific function appertaining to it; and that taken together as a system they will work in perfect mechanical harmony, so as to produce perfect saturation of wood, and other fibrous and cellular substances, with fireproofing and preservative liquids; give a clear and simple explanation of how it is accomplished?

Answer: The Company has practically proved, and is willing to demonstrate by its process that there can be no question that a steam boiler will supply steam to a

steam pump; that a steam pump, specially designed for the purpose, will supply any required liquid at any required pressure to an hydraulic accumulator. That an hydraulic accumulator will absorb the impulses of a reciprocating steam pump, and will deliver the liquor passing through it without shock to another body of liquor in a fixed receptacle, or cylinder, imparting its accumulated pressure, due to its load, to the liquor in the fixed receptacle. That any wood, or other fibrous or cellular substance, contained within the body of liquor in the fixed receptacle, or cylinder, will be impregnated by the liquor surrounding it in spaces of time proportioned to the specific densities of the woods, and the methods of distributing the pressures upon the liquor. That the patented gate of the cylinder, or fixed receptacle, is pressed to its seat by the pressures applied to the body of liquor within the receptacle, and that the greater the interior pressure the more firmly seated is the gate. That the accumulator pressure lifts the gate clear of the opening with great rapidity, and sustains it in a fixed position as long as required. That the shifting of the operating valve permits the closing of the gate in a few seconds. These are the sequent functions of the individual parts of the apparatus, and by a series of demonstrations it is absolutely indisputable that each part fulfills, and will continue to fulfill, its function.

17. Has the Company made a sufficient number of tests to prove that the results obtained are reliable?

Answer: Yes. The plant has been in daily practical service, and used for scientific and public tests, since August, 1899.

18. Are the tests made with a plant of a size that proves that the tests are applicable to woods of a size required for commercial purposes?

Answer: Yes. The work is done with a demonstrating plant, having a round impregnating cylinder—ten feet long, and of an inside diameter of eighteen and one-half inches.

19. Does it require mechanical skill to form a conclusive opinion as to the results achieved by the plant and process?

Answer: No. It is only a matter of a personal examination, and a test of the wood treated by the process.

RESULTS.

20. How does this new process compare with that in use in New York, Newark, and London?

Answer: The extent of saturation, the kind and sizes of woods saturated, the length of time it takes to do it in each instance, and the apparatus and pressures, and processes employed in the above cities, and elsewhere, are well known, as well as a fair idea of the cost of operation, and so far we have not seen or heard of a plant and process that, for simplicity, economy, and thoroughness of operation, compares favorably with the mechanical appliances and processes used by this Company, and no defect therein has been discovered by critics or experts.

21. What has been the result of the investigation of the plant and process by scientists, engineers, and mechanics?

Answer: Reports of a few independent tests are appended hereto, and these investigations, with the many others made from time to time, show that the following properties and results have been demonstrated:—

The ability of the process to give heart saturation, within a remarkably short time, at a comparatively small cost, to all kinds and sizes of lumber for commercial purposes.

The effectiveness and permanency of the fireproofing liquor, and that it is non-corrosive, non-hydroscopic, and non-volatile.

The treatment does not weaken, or in anywise affect, the fibrous tissues or cells, or otherwise injure lumber, nor change its color or other natural properties, but on the contrary the treatment does improve and tend to preserve it.

The lumber thus treated is as easy to work with tools, and will more readily take and hold varnishes, paints, and oils, than untreated lumber.

The lumber treated by this process will not hold flame or spread combustion, but is completely and permanently fireproofed.

The Company, for the use, advantage, and protection of itself, and of its licensees, and realizing the wide field for the use of its products, maintains a demonstrating plant in Philadelphia, and has in its employ mechanical ability of a high order to superintend the erection of commercial plants, and develop, by continual tests with all kinds of woods, the working powers of its patented plant and process.

UNITED STATES FIREPROOF WOOD COMPANY,
2220 Race Street, Philadelphia, Penna.

MARCH, 1900.

REPORT OF PROFESSOR SMITH,

Director of the John Harrison Laboratory of Chemistry, University of Pennsylvania.

PHILADELPHIA, March 4th, 1899.

J. C. Sims, Esq.

MY DEAR MR. SIMS:—Various samples of wood, after treatment by the Ferrell process, were exposed to heat in the air and in crucibles of platinum. They, in no instance, held flame after the removal of the lamps, nor did they impart flame to adjacent objects. Splinters, blocks, and large pieces of wood were tested. Samples of untreated wood were subjected to the same tests and from their behavior it was evident that "fire-proof" could be unquestionably claimed for the "treated" wood. No destruction of the fibre, as the result of treatment, was noticeable.

Yours truly,

(Signed) EDGAR F. SMITH,
Prof. Chemistry.

REPORT BY CHARLES F. ALBERT.

(Manufacturer of the celebrated Charles F. Albert's Grand Concert Violins and Bows.)

PHILADELPHIA, March 11th, 1899.

United States Fire-Proof Wood Co.

GENTLEMEN:—I have thoroughly tested the samples of your fire-proof wood in various ways and find that the process is all that you have claimed for it. As a result of my experiments, the skeptical ideas which I at first entertained have been thoroughly changed with regard to the action and influence which the chemicals have on the woods, particularly with reference to the natural vitality, pliability and strength of the woods, the effect on sharp edged tools, also as to staining, filling, varnishing and glueing, also the result of thorough scrubbing, and finally with regard to the fire-proof qualities of the wood when exposed to strong flames.

VITALITY OF WOOD NOT AFFECTED.

I cut the prepared wood in strips of different sizes and lengths, and compared it with strips of unprepared wood of the same size, and found that the prepared wood was equal in strength and elasticity to the unprepared wood, and that the treated wood had lost none of its vitality in any respect; in fact, I noticed that some species of the prepared wood, such as yellow pine and wood that contained resin, proved even stronger, probably due to the pores being filled up with the salts used in the treatment, which makes the wood closer, harder and more solid.

WILL HOLD NAILS FIRMER THAN UNPREPARED WOOD.

I have tested the prepared wood by driving different kinds and sizes of nails—both wire nails and American nails into it, and in comparison with the unprepared wood found it required more force to draw the nails from the prepared than from the unprepared wood.

Has no Injurious Effect on Tools.

I found in planing, sawing, drilling, gouging, &c., that the edges of the most delicate tools were not affected in their use on prepared wood, any more than on the unprepared woods.

Can Easily be Stained, Varnished, Etc., and Holds Better than on Ordinary Woods.

I have stained and varnished some of the woods in various ways, and find that the treated holds stains of all kinds and appears richer; that the grain is filled up quicker, and holds varnish much firmer than in the case of the unprepared woods.

Holds Glue Well.

I split some of the samples of prepared wood and glued them together, and found that it held as well as the unprepared wood.

The Wood will Split in a Natural Manner, and Absolutely Clean.

I found from my experiments that the wood will split in a natural manner, and absolutely clean, and will not gore. It can be planed or sawed in any manner, and form the same as natural wood, and as easily as any of the unprepared woods.

Not Influenced by Being Under Water.

I made some tests to find out what influence water might have on the prepared samples when thoroughly soaked, as in the case of long rains, or where, as in the case of a fire, water might be thrown upon the wood after it had become charred. I took a small piece 2″ long by 1″ thick from a larger piece of one of your samples of very soft white pine, put it under water and soaked it for 48 hours. When dry, I tested it by holding it in a strong flame, but it would not burn. Not satisfied with this, I split it and cut out from the centre a small piece of the size of an ordinary

match. This I held in the flames, and to my surprise it would not burn. This was a most satisfactory proof to me that the sample woods are thoroughly impregnated with the chemical, and that, however this may have been done by you, it has been well done.

Entirely Fire Proof.

By the following various tests which I have made, I became thoroughly convinced that the woods prepared and impregnated with the chemical salts, like your samples, are positively fire-proof. I tested the woods by planing off a handful of very fine shavings, and put them on a piece of platinum and held the same over a strong flame, and the pieces would not burn. I took some shavings from unprepared wood and tested them in the same way, and they immediately burst into flames. I took some of the shavings of the prepared wood and threw on the burning ones, and the flames were extinguished. I then sawed up some wood, gathered up the saw-dust, and exposed same to the flames and found it would not burn. I put some benzine in a plate, set it on fire, took some sawdust from the prepared wood, and threw it into the burning fluid, and the flames were immediately extinguished—smothered. Such saw-dust would make an excellent fire extinguisher for family use. I also tested the yellow pine containing a great deal of resin by soaking one end in machine oil, then held it in the flames, but it would not burn, although the oil began to boil on the wood.

In conclusion, I think your process of preparing woods to make same fire-proof is one of the greatest inventions and discoveries of the present age, and I only hope that in the near future I will see sufficient wood prepared in quantity to supply all new buildings erected thereafter with such prepared fire-proof timber as your samples. What a great blessing it would be to live in a house and under a roof that one knew to be thoroughly fireproof.

Yours, very truly,

(Signed) CHARLES F. ALBERT.

A Wood Fireproofing Plant.

(From the *Engineering Record,* New York, Dec. 2, 1899.)

The United States Fireproof Wood Company, of Philadelphia, has now in continuous operation there a plant for the practical fireproofing of commercial sizes of lumber and timber by the Ferrell patent process. All varieties of wood in sizes up to 12 x 18 inches, and 10 feet long, have their pores filled, under heavy pressure, with a liquid which makes it non-inflammable without apparently impairing its strength, or perceptibly changing any of its physical properties, except to increase its specific gravity slightly. This plant has been installed to demonstrate a simple treatment by which any piece of wood is made incapable of ignition, to show the details and operation of the hydraulic machinery, which has been built for the rapid application of great pressures, and for the investigation of the material treated.

The working plant is on the first floor of a warehouse building, and is remarkable for its simplicity, compactness, and convenient operation with a minimum of hand labor. The essential apparatus consists of a steam boiler, a pressure and a circulation pump, a pressure accumulator, a charging tank, and the receiver. Besides these there are a wood-drying kiln, an experimental kiln, and a laboratory upstairs. The complete process, except artificial drying, which is optional, now requires only about an hour, including charging and operating the receiver, for timber 1 inch thick, and proportionately longer for greater thicknesses. It consists of placing the wood in the receiver, closing the gate, admitting the liquid, applying and maintaining the pressure for the required period, withdrawing the liquid, and removing the wood.

The receiver is a cast-iron cylinder, 18 inches inside diameter and 11 feet long, with walls 3 inches thick, and flanges at both ends. One end is closed by a heavy domed casting, bolted on, and to the other end is bolted the gate housing, a large cast-iron chamber like a valve

body, with a domed cover bolted on top. In this chamber the gate, 5 inches thick, moves freely, with clearance, between vertical guides. Its stem passes through a stuffing box in the top of the cap and is connected above it to the piston of a small vertical hydraulic cylinder, by which the gate is fully opened or closed in 5 seconds. When closed the outside of the gate engages an annular vertical seat of phosphor bronze, and is forced up against it by the interior pressure, which, increasing, closes it tighter and tighter, and decreasing, relieves it from all friction and allows it to be opened by merely raising it. The concave bottom of the receiver is covered with an iron grating, which has rollers on the upper side to receive the charge of timber. Under this grating there is a coil of 1-inch steam pipes for heating the liquid. The fireproofing liquid is prepared in a 300-gallon steel mixing tank, and drawn thence into a smaller filling tank, from which it runs by gravity to the receiver. The discharge pipe of 6 x 6 x 1-inch Worthington high-pressure pump is connected to the accumulator cylinder, and the latter communicates with the receiver by a valved pipe of 3/8-inch internal diameter. The accumulator cylinder is 2 inches in diameter inside and 3 feet long, and its piston is loaded with sectional cast-iron disks of about 3000 pounds total weight. The arrangement of the entire plant is shown in the engraving, where the receiver is in the foreground, with its gate closed. Immediately above it, at the right, are the two tanks, and at the right of them is the accumulator, near the top of its stroke, with the pressure and circulation pumps and the boiler successively beyond it, near the wall.

In the complete operation for the treatment of one lot of timber, the receiver gate is first opened by moving the small lever which commands the four-way valve on the pressure pipe to the cylinder just above the gate housing. The wood is inserted in the receiver and the gate closed by the same lever. A valve is opened and the receiver filled by gravity with the fireproofing liquid. The valve in the supply pipe is closed and that in the pressure pipe

partly opened, and the pressure is gradually raised to several hundred pounds with a rapidity regulated at will by throttling.

While the pressure is being applied the liquid is also being heated by the steam coil, the effect of the higher temperature and the increased pressure resultant from it being important factors in the process. As the liquid penetrates the wood its volume is replaced, and the pressure maintained by the automatic action of the accumulator, the pump of which is in constant slow operation, except when at the upper limit of its stroke; then it engages a lever which shuts off the steam until it has descended a short distance. After the wood has been sufficiently treated the pressure valve is closed, the emptying valve opened, the unabsorbed liquid pumped back from the receiver to the tank, ready for use again, and the receiver gate is again opened as at first described. One man is sufficient to perform all the operations except firing the boiler and handling heavy timber. Adjacent to the receiver room a kiln about 10 x 10 x 40 feet long has been built for drying the fireproofed wood with a hot-air blast. A 30-inch American Blower Company's fan, driven at 350 revolutions, forces the air through 500 feet of ¾-inch steam coil and discharges it at about 130 degrees under the floor rack in the bottom of the kiln. After circulating through the kiln the air escapes through registers in the lower part of the double-sided walls, and is carried off over the false ceiling to the exhaust stack.

In a recent test, four white pine boards, 1 inch thick, 12 inches wide, and 7 feet long, weighing 64½ pounds, were placed in the receiver at 2.28 P. M. The gate was closed, the liquid admitted, and the pressure valve opened at 2.33, the accumulator being at full stroke and set to a pressure of 900 pounds per square inch. At 2.45 the mercury gauge indicated a pressure of 90 pounds in the receiver. At 3.15 the mercury main gauge showed a pressure of 500 pounds, and the attached thermometer a temperature of 100 degrees. Steam was cut off from the heating coil and the pressure valve closed to one-sixteenth of the

full opening, and this pressure and temperature were maintained steadily until 3.22, when the pressure was cut off and the liquid pumped out of the tank. The gate was raised and the wood withdrawn at 3.31; when weighed again it was found to have increased to 155½ pounds, showing an increment of about 112 per cent. above its original weight.

It is generally believed that an absorption of 80 per cent. is ample to effect absolute incombustibility, so by reducing the saturation to the useful amount, providing quicker filling and emptying pumps, and arranging double doors for the charging of another lot of wood as the preceding is withdrawn at the other end, this rate of treatment may be made much more rapid.

The normal weight of seasoned white pine is 2¼ pounds per foot board measure, and when it has absorbed 80 per cent. of its weight of fireproofing liquid and has been thoroughly kiln dried, it weighs 2½ pounds a foot and shows no difference in color, or under cutting tools. Wood of all kinds and of all commercial sections is apparently treated to the heart and saturated to any required degree up to 200 per cent., with any one of several liquids which have been especially developed for this process. The average number of minutes required to secure a saturation of 130 per cent. for any medium or soft wood is the same for all pieces of the same thickness; it is 40 minutes for one inch, 50 for two, 80 for four, 95 for six, 135 for eight, 170 for ten, and longer in proportion for greater thicknesses. This impregnation averages 50 per cent. higher than is necessary to make the wood fireproof, and the figures show the rapidity with which a high degree of saturation is accomplished by this process. Oak and yellow pine are more resistant, but can be thoroughly saturated to the same degree as the soft woods.

From every charge of wood two samples are saved before and two after it is treated. One piece of each set is preserved for future reference, and the other is tested and the results recorded. From these records selected experiments are platted on cross-section paper to show

temperature and pressure curves, with times for the abscissas and gauge readings for the ordinates. Combustion, tensile, and other tests are also made, and formulas for the liquid, and the method of treatment for different kinds and sizes of wood are prepared to enable any desired result to be obtained at will.

Very small thin shavings of another piece were exposed to the flame of a Bunsen burner without any signs of burning or flame; after ten minutes they were charred but had not crumbled away. These and other tests demonstrate that the treatment will make the wood non-inflammable, and enable it to endure fierce heat for a considerable time with only gradual charring and crumbling.